Town of Raynham, Massachusetts

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Appendix A - Sewer Line Testing

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Line Testing

All sewage pipelines and structures shall be tested once construction is completed. Tests shall include:

1. Gravity Lines - Hydrostatic (infiltration and exfiltration) or low-pressure air test.
2. Manholes - Hydrostatic (infiltration and exfiltration) or vacuum test.
3. Pipe Deflection test on gravity lines.
4. Manhole to manhole alignment test.

Hydrostatic Test on Gravity Lines and Manholes

1. All gravity type sewers shall be subjected to either an infiltration or an exfiltration test at the direction of the Engineer. The type of test required will be contingent upon groundwater conditions in the area where lines are to be tested. These tests shall include losses or gains through manholes as well as through pipe walls and joints, as well as through house connection fittings and pipe. No building shall be connected to a newly installed sewer until the sewer has been satisfactorily tested.

2.Where lines are installed in areas having a high ground water level, an infiltration test continuing for at least four (4) hours shall be carried out by the Contractor under the supervision of the Engineer. Watertight plugs shall isolate various sections of the sewer and the quantity of water entering the pipe during a predetermined time shall be measured. If the conditions are such that the groundwater table varies depending on surrounding influence and time of the year or if the table elevation is unknown at the time of testing, the Contractor will be required to excavate test holes as directed by the Engineer.

3.Where lines are installed in relatively dry areas, an exfiltration test shall be imposed on the sewer. This test shall be carried out by isolating various sections of the line by watertight plugs and filling the line with water to a predetermined level. The loss of water in a predetermined time shall be determined by measuring the quantity of water required to refill the line to the original level.

4. The length of line tested at one time shall be as directed by the Engineer and shall be dependent upon the grade of the sewer.

5. Losses through manholes shall be included in determining the loss in a line.

6. The maximum acceptable loss, through either infiltration or exfiltration, shall not exceed 200 gallons per mile per 24 hours per inch of diameter of the pipe tested. When two (2) or more pipeline sections are tested at the same time, the allowable leakage for the shortest section shall be used as the acceptable loss for the entire length being tested.

Low Pressure Air Test on Gravity Lines

1. After completing backfill of a section of pipe, the Contractor shall conduct a Line Acceptance Test using low-pressure air. The test shall be performed according to the specified procedures and under the supervision of the Engineer.

2. The following testing procedures shall be followed:

a. All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.

b. After a manhole to manhole section of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psig greater than the average back pressure of any groundwater that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize. After the stabilization period (3.5 psig minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of the line being tested shall be termed "Acceptable" if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any groundwater that may be over the pipe) shall not be less than the time shown for the given diameters and lengths in Table 1.

c. All air tests shall cover a 1.0 psig pressure drop; 0.5 psig pressure drop tests are not acceptable.

d. In areas where groundwater is known to exist, the Contractor shall install a one-half inch diameter capped pipe nipple, approximately 10" long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately before the performance of the Line Acceptance Test, the groundwater shall be determined by removing the pipe cap, blowing air through the pipe nipple to remove any obstructions, and then connecting clear plastic tube to the nipple. The hose shall be held vertically and a measurement of the height shall be taken after the water has stopped rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the pressure in pounds per square inch (psig) that will be added to all readings. (For example, if the height of water is 11-1/2 feet, then the added pressure will be 5 psig. This increases the 3.5 psig to 8.5 psig, and the 2.5 psig to 7.5 psig. The allowable drop of one pound per square inch and the timing remains the same.

e. The maximum starting test pressure should not exceed 9 psig, regardless of groundwater level above the pipe. If the groundwater level is such that the added pressure would be greater than 5.5 psig (12.7 feet), the pipe section may be tested using a starting pressure of 9 psig.

f. Each pipe nipple installed to measure groundwater levels should be recapped subsequent to the air testing procedure to prevent future infiltration.

g. As an alternative to installing a pipe nipple in a manhole to measure the height of groundwater, the Contractor shall excavate a test pit over the pipe to determine the height of groundwater.

Vacuum Test on Manholes

After the manhole has been constructed, the Contractor shall conduct a Manhole Acceptance Test using the following vacuum test procedure:

1. Plug all lift holes with an approved non-shrink grout.

2. Plug all pipes entering the manhole, taking care to securely brace the plug from being drawn into the manhole.

3. The test head shall be placed at the inside of the top of the cone section and the seal inflated according to the manufacturers' recommendations.

4. Draw a vacuum of 10 inches of mercury and shut off the vacuum pump. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass if the time is greater than:

1 min. 0 sec. for 0'-10' deep manholes
1 min. 15 sec. for 10'-15' deep manholes
1 min. 30 sec. for 15'-25' deep manholes

5. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout. Re-testing shall proceed until a satisfactory test is obtained.

Allowable Deflection Test on Gravity Lines

1. Pipe deflection measured not less than ninety days (90) after the backfill has been completed as specified shall not exceed five (5.0) percent. Deflection shall be computed by multiplying the amount of deflection (nominal diameter less minimum diameter when measured) by 100 and dividing by the nominal diameter of the pipe.

2. Deflection shall be measured with a rigid mandrel (Go-No-Go) device cylindrical in shape and constructed with a minimum of nine or ten evenly spaced arms or prongs. Drawings of the mandrel with complete dimensions shall be submitted to the Engineer for each diameter of pipe to be tested. The mandrel shall be hand pulled by the Contractor through all sewer lines.

3. Any section of pipe not passing the mandrel shall be uncovered at the Contractor's expense and the bedding and backfill replaced to prevent excessive deflection. Repaired pipe shall be re-tested.

Manhole to Manhole Alignment

1. All gravity sewers shall be laid accurately to line and grade using batter boards or lasers.

2. After completion of the sewer construction, including backfilling, it must be possible to sight from manhole to manhole through the pipe. This accuracy of laying the pipe can be easily checked as construction progresses.

3. In the event that the completed sewer main fails to meet the requirement for alignment because of horizontal displacement, the Contractor will be allowed to construct intermediate man holes at his own cost. In the event that the completed sewer main fails to meet the requirement for alignment because of vertical displacement, the Contractor will be required to remove and replace the sewer to the proper grades.

Test Failure

1. In case leakage exceeds the above-specified amounts, the contractor shall locate the leaks and shall repair at his own expense.

2. Pipeline with shear-type breaks, fishmouths or damaged gaskets, cracked bells or couplings, hairline fractures, or structural damage of any type shall be replaced in kind. Mechanical sleeve couplings, poured concrete collars or similar repairs are not permitted. The use of pressure grouting repair techniques will not be allowed without the written consent of the Engineer.

3. After repairs have been made, the line shall be re-tested and the processes of repairing and re-testing shall be repeated until results within the above-specified limits are obtained.

Line Testing Results

After all sewer lines and structures have been tested, repaired and accepted by the Town, the following documents will be turned over to the Board for their review:

1. Gravity line testing results.
2. Sewer manhole testing results.
3. Pipe deflection-testing results.

These testing documents will either be certified by a qualified testing firm or stamped by a registered professional engineer.

Final Physical Inspection

Upon receipt of the above-certified line testing results, the Board or its representative will conduct a final physical inspection of the constructed works. For this inspection the contractor will provide the following:

1. Instruments that will continually monitor oxygen deficiency and methane gas in the manhole.

2. Equipment and personnel to expedite emergency evacuation from the manhole.

3. Proper traffic control and safety devices and equipment during conduct of the inspection.

Final Acceptance Tie-In

Before final acceptance and physical tie-in to the public sewer, the applicant will furnish the Board with the following applicable documents:

1. Submit all easements for the sewer line in the name of the Town.

2. Furnish a bond in the amount determined by the sewer Superintendent to cover the cost of any accident or damage that may occur in consequence of the laying of the sewer. This bond must cover a period up to one year after the sewer is laid according to Article II, Section 15 of the Sewer Use By-Law.

3. Submit a reproducible and complete (not marked-up) set of as-built plans for the sewer installation that reflect the following minimum requirements:

a. Gravity line sizes, pipe type and slope for each section between manholes.

b. Gravity line service connection locations as determined by ties to two known and identifiable points.

c. Gravity line service connection sizes, slopes and final elevation.

d. Manhole numbers, rim and invert elevations.

e. A plan benchmark location.

f. Sewer line plan and profile.
g. Gravity line pipe foundation details.

h. Sewer manhole installation details.